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INTERACTING PROCESSES IN THE CHILD'S ACQUISITION OF STOP-LIQUID CLUSTERS*

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ABSTRACT

Children's productions of words with stop-liquid clusters in the adult model are compared across six languages. Although the children learning these languages need not follow the same course of learning, processes operative on adult clusters are shown to be very similar. The children's productions all progressed through the same three major stages, and their alternative productions seemed to be controlled by similar temporal and phonological factors.

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Although all children learning a language which possesses consonant clusters generally learn to produce such sequences, they need not follow the same course. That is, their learning need not include identical phonological processes[1] nor invariant productions at a given age. The purpose of the following remarks will be to show which processes are operative during the course of acquisition for one particular type of consonant cluster, and to show how these processes interact to produce concurrent or sequential variants in children's productions.

The production of initial clusters of the stop-liquid type appears to progress gradually from no recognition of the second segment in the child's speech to the correct articulation of the whole sequence. Since liquids as single consonants are acquired late while some single stops are produced appropriately at an early age, this progression is not particularly surprising.[2] There are three major stages of production attested in individual studies of developmental phonology: liquid-deletion, substitutions for the adult liquid, and finally correct production. Even an early observer like Ament (1899), cited in Leopold (1947:36-7), who believed that in general "the first consonant [of a cluster] is dropped and the second treated in the regular manner" was forced to make an exception in the case of C+r clusters, which appear to be treated in just the opposite fashion in early productions.

In order to investigate the acquisition of consonant clusters in more detail, data was collected from previously published studies of children learning six different languages. The data sources are listed in Table I, along with the names of the children studied. All replicas of words with initial clusters in the model which were produced in other than the adult manner were listed, and an analysis of

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[1] I am using the term 'phonological process' for what is generally called a phonological rule. I do not mean to identify the processes exemplified in the following remarks with phonological processes of the type outlined by Stampe (1969).

[2] Templin (1966:177) states that /l/, /r/, and /s/ are "the most common misarticulations in the caseload of public-school speech correctionists. ..." Grégoire (1947:346) remarks that "Charles et Edmond se montrent pendant tout la troisième année réfractaires à l'emploi normal de cette consonne," i.e. /r/. Shvachkin (1948, reprinted 1973:109) found that while the perceptual distinctions between liquids are learned after those between obstruents and sonorants, distinctions between liquids and [j] are learned very late.

However, clusters of C+r have been reported for children learning such diverse languages as Czech, Latvian, Italian, and Swedish, as the first phonetic sequence in which correct /r/ appeared; usually the cluster was (-)tr-. Cf. Ohnesorg (1959: 152), Ruķe-Draviņa (1973: 160), and Engel (1973:158).

substitutions along a time continuum was made.[3] It should be noted that although the three stages, from liquid deletion to liquid substitution to correct production, are generally confirmed by the data, not all words in the data give evidence for each stage. The absence of the first stage, liquid deletion, might be the result of any of three factors: (1) the infrequency of words with this particular type of cluster in the child's vocabulary, (2) a strategy of avoidance on the child's part,[4] or (3) a simple gap in the data collection. Thus, although the three-stage view is generally borne out by the data, it is not confirmed by all words in the data.

Table I: Sources

Czech:	Karel Ohnesorg, 1958. Foneticá studie o dětske řeči. Prague: Charles University. (Charles)
English:	Werner F. Leopold, 1947. Speech development of a bilingual child, vol. 2: Sound learning in the first two years. Menasha, Wisconsin: Northwestern University Press. (Hildegard)
	Neilson V. Smith, 1973. The acquisition of phonology: a case study. London: Cambridge University Press. ('A')
Estonian:	Marilyn M. Vihman, 1971. On the acquisition of Estonian. PRCLD, 3, 51-85. (Linda)
French:	A. Grégoire, 1937 and 1947. L'apprentissage du langage, 2 vols. Paris: Droz. (Charles, Edmond)
	Jules Ronjat, 1913. Le développement du langage observé chez un enfant bilinque. Paris: Champion. (Louis)
Serbian:	Milivoïe Pavlovitch, 1920. Le langage enfantin: acquisition du serbe et du français par un enfant serbe. Paris: Champion. (Douchan)
Slovenian:	Rudolf Kolarič, 1959. Slovenski otroški govor. Godišnjak Filozofskog Fakultete u Novom Sadu. Knjiga 4, 1-30. (Thomas, Maja)

[3] Please note that I have not included the Czech /ř/ as a liquid in the discussion to follow. This segment has much in common with fricatives in Czech, and appears to pattern in Charles Ohnesorg's phonological development as a fricative. /ř/ is strident; it also undergoes voicing assimilation which typically is a property of obstruents in Czech. In Charles' speech, the most common substitutions for /ř/ are the palatal fricatives /ʃ/ and /ž/. Cf. Kučera (1961).

[4] Avoidance strategies for single consonants and clusters have been discussed by Ferguson and Farwell (1973) and Ingram (1972). Engel (1973) reports that her son, learning Italian, avoided producing words with /r/ as late as (3.6).

In addition to the two overall processes of liquid deletion and substitution, several other subprocesses were found. These processes are: deletion of the entire sequence (∅), velar-dental interchange (V-D), deletion of the stop while retaining the liquid (L), weakening of the stop (W), insertion of an epenthetic vowel (E), and metathesis or 'migration' of liquid segments (M). Velar-dental interchange is used here as a cover term for types of substitution: dentals for velars, e.g. Edmond (2;0,12) croûte 'crust' as [tut],[5] and velars for dentals, e.g. A. (2;8,2) drink as [gliŋk]. These substitutions often represent anticipatory or perservative assimilations, which bring about consonant harmony. Stop-weakening is defined as a replacement of the stop by a fricative; in effect, weakening is an assimilation also, since a [-continuant] segment is replaced by a [+continuant] one, in agreement with the [+continuant] feature of the following liquid, e.g., Charles Ohnesorg (2;8) krám 'shop' as [xla:m].

Table II lists the processes which operate on the adult clusters. The processes are listed from ∅ or single element productions up to the time at which clusters began to appear in their adult form. The column labelled 'stop' indicates that during the time-period given, the child produced clusters with liquid-deletion, making stop-liquid

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[5]A note on transcriptions is needed. Grégoire (1947) uses standard French orthography in his examples of Charles' and Edmond's speech. I have rendered these orthographic representations into IPA transcription when I believed they were unambiguous; elsewhere, they are given in quotes. Other authors' transcriptions have been left basically unaltered. Smith uses a dot [ç̇] or [ċ] for 'voiceless, lenis articulation' (p. viii). IPA [x] has been used for Ohnesorg's ch.

Dating of processes in Table II is approximate. For the process of liquid deletion, I have dated the stage from the first to the last example cited by each particular study, except when later examples were isolated, e.g. A. produced a single example of liquid deletion at (3;5), long after most clusters were acknowledged in production as having a second segment. Isolated examples such as this one are marked with an asterisk.

Smith's examples have been converted from stages to approximate months, weeks, and days so as to be comparable with data from the other languages.

Four children in the sample provide little or no evidence for consistent production of two elements: Linda, learning Estonian, Hildegard Leopold, and the two Slovenian children. Specific examples for Douchan, learning Serbian, and for louis Ronjat are also taken mainly from early productions, thus providing little data on later processes operative in their phonological development.

Language	Single Element				Two-Elements					
	∅	stop	V - D	L	V - D	C+L (sub)	W	E	M	Correct
Czech	–	1;11 -2;9	1;11-2;6	2;9	2;6-3;0	2;6-3;5	2;7-2;8	–	–	C+1: 2;4 C+r: 3;5
English (Leopold)	–	1;0-	1;6 -	–	–	one word 0;10-1;9	–	–	–	one word:[pr-] 0;10-1;9
English (Smith)	–	2;2-2;9 3;5*	2;2-2;6 velar assimilation	2;2	2;7-2;8 velar assimilation	2;6-2,9	3;1	2;6-2;7	2;6-2;11	2;6
Estonian	1;7	1;7-	–	–	–	–	–	–	–	–
French (Gregoire)	2;0	2;0-2;7 2;11*	1;11-2;3	1;11	2;1-2;5	2;1-2;9	2;3	2;4-2;6	2;0-2;7	2;5
French (Ronjat)	2;4	1;8-	–	2;4	–	1;10-2;2 4;0	–	3;5-4;0	2;0	C+r: 2;7
Serbian	–	1;5-	1;10 velar assimilation	–	–	1;10	–	1;10	2;6	–
Slovenian	1;6	1;5-	1;6-2;0	1;7	–	1;11	–	–	–	one example, 1;9

* is used to make isolated instances of a process

Table II: Age at Which Phonological Processes Are Operative on Stop-Clusters in the Adult Model

clusters and simple stops homophonous.[6] The notation 'velar assimilation' indicates that the only type of velar-dental interchange which occurred was substitution of velars for dentals; this process will be discussed more fully below.

Although Table II does not list examples of all the processes for each language, it does show certain similarities across children and across languages. All children whose speech was recorded beyond two years of age manifested at least beginning progress toward recognition of the liquid segment in their production of stop+liquid clusters. Deletion of the entire sequence occurred fairly early while epenthesis, if it occurs, was found just before or during the time when clusters were being produced correctly, except for one Serbian example.[7] Stop-weakening and deletion appear to have relatively short duration as opposed to the more general process of liquid deletion and substitution. Although the processes are arranged in rough chronological order from left to right, considerable overlap can be seen between the time of operation of different processes. For example, Charles Ohnesorg, learning Czech, produced clusters in three different ways between 2;6 and 2;9: some were identical with the adult model; others underwent liquid substitution, e.g. brána 'gate' [bla:na] (2;8), and still others remained homophonous with simple stops, e.g. brousek 'whetstone' [boux'et] (2;6). In five of the languages, deletion of the liquid overlaps with liquid substitutions. Linda, learning Estonian, had not produced any liquids or liquid substitutions for this type of cluster by the end of data collection (1;10). Hildegard Leopold's productions of a single word pretty remain rather mysterious, since it

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[6] Although adults may judge simple stops from underlying C+r clusters and from single stops to be homophonous, several studies, e.g. Menyuk (1971) have examined children's productions of consonant clusters spectrographically; these measurements indicate that underlying clusters are distinguished by duration and offglides from underlying single stops, even though adults do not hear this distinction in the child's productions.

[7] Examples of epenthesis in Grégoire's data may be misleading, however, since they occurred only under imitation; train was produced as 'touwain' at (2;4) and as 'tərain' at (2;6). Pavlovitch (p. 75-76) makes the following statement about Douchan's use of epenthesis, ... 'quand il s'agit des consonnes déjà bien fixées, le sujet parlant les prononce distinctivement, non avec une seule émission de voix, mais en deux syllables, en introduisant une voyelle parasite.' Evidently /r/ was beginning to be 'fixed' as early as 22 months in Douchan's speech. In contrast, Ronjat's son used epenthesis quite late, at 4 years of age.

was chiefly in this word that liquids and liquid substitutions appeared.[8] Leopold described pretty as a 'mechanically imitated word,' (p. 33) which first appeared in a quite accurate reproduction at 0;10. Up until 1;8, pretty was whispered, but 'as soon as it was articulated aloud, 1;9, the r was left out and appeared only once more, later 1;9, in the shape of the substitute w after p.' (p. 72). The general rule for Hildegard's production C+ liquid clusters was deletion of the liquid.[9]

For those children in the data whose speech showed several processes in operation across time, temporal overlap between the end of operation of one process and the beginning of another could be manifested in at least two different types of interaction: 1) Processes could operate during the same time period, but were mutually exclusive. E.g. two very general processes, liquid-deletion and epenthesis, although overlapping in time of operation were mutually exclusive in forms to which they may apply. If liquid-deletion applied, then epenthesis could not apply.[10] Temporal interaction

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[8] Variants of this initial cluster included [pç-], [ps-], and [pʃ-]. Moskowitz (1971) has cited pretty as an example of a "progressive phonological idiom," which indicates that Hildegard is capable of producing phonetic sequences beyond the level of organization of her phonological system. Leopold's statement that pretty was "mechanically imitated" also notes the peculiar status of this form in Hildegard's phonological system. After 1;9, when pretty was produced with normal voice, it became subject to a general constraint of her phonology at the time: the initial consonant became voiced, and the liquid was dropped.

[9] Leopold also gives some examples of continuant segments for clusters, such as [β] for br- which may show beginning recognition of the second element, as well as stop-weakening. However these examples are exceptions to the far more general pattern of liquid-deletion.

[10] By "mutually exclusive" is meant that the two processes may not both operate in the derivation of a single form. Epenthesis needs a sequence CC as input for its operation; since liquid deletion removes one of the consonants in the type of cluster discussed here, their operation in the derivation of a single form is incompatible. These two processes may indeed operate during the same time period, as in A.'s examples below. A further possibility, although speculative, is that for some children, processes may apply to different word-sets.

between these two processes was shown by varying phonetic forms of the same cluster in the child's speech during the same time period. 2) Other processes, such as liquid-deletion and velar-dental interchange did not show a mutually exclusive interaction. Forms may be found in the child's productions in which one or the other, or both applied.

The first type of interaction may be exemplified by the speech of A., learning English. A. varied between simple stop, epenthesis, and liquid substitutions; he made use of epenthesis just before correct clusters appeared, but also 'regressed' to a simple stop after epenthesis.

bread (2;6,16) [bərɛd] ~ [bəɪɛd]
(2;6,23) [b̪ɛd] ~ [b̪rɛd] ~ [b̪lɛd]
(2;7,17) [blɛd] ~ [brɛd]

A similar interaction between liquid-deletion, liquid substitution, and correct clusters appeared in the speech of children learning French and Czech.

The second type can be shown by Charles Ohnesorg's forms for the word 'hammer' kladivo between 2;2 and 2;7.

(2;2) [tad'ivo] Both liquid deletion and velar-dental interchange apply;
(2;7) [xlad'ivo] Liquid-deletion does not apply; stop-weakening.
later(2;7) [tlad'fto] [xlad'ifto] Alternation between V-D and stop-weakening.

Velar-dental interchange showed a considerable temporal overlap with other processes in the data for children learning English, Czech, and French; at least one sub-type of this interchange remained active until some clusters were being produced in the adult manner.

The cover-category of 'velar-dental interchange' includes two different types of substitutions, as was mentioned above. Both anticipatory velar-assimilation and substitution of dentals for velars are well-documented processes in developmental phonology, and their application is not limited to consonant clusters.[11] The two

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[11] Jakobson (1968:47) noted the replacement of velar stops by dentals as evidence for setting up a hierarchy of tonality distinctions among consonants: "it is apparently a universal fact ... that palato-velar sounds develop in child language only after dental sounds."

There are abundant examples of anticipatory velar assimilations in Smith's data, as well as some perserverative assimilations for single consonants. Anticipatory assimilations include: dark [ġa:k], snake [ŋe^{i}k], leg [ġɛk], all produced around 2;2. Kiss [ġik]

Belgian children studied by Grégoire also presented examples of substitutions of velars for dental stops: e.g. Edmond (2;3,6) dromadaire 'camel' as 'gomade' and (2;3,18) tram as 'kam'. The same child produced croûte 'crust' as [tut] at 2;0,12 and grillé 'toasted' as [dije] and [di:je] at 2;0,28 . Examples of velar-dental interchange in Smith's and Pavlovitch's data represent cases of velar assimilation. For Serbian, Pavlovitch reports druga 'another' as [gugu] or [guga] at 1;10 with anticipatory velar assimilation and reduplication. At around 2;6,23 A. operated with a phonological constraint which prohibited the appearance of the sonorants /l/ and /r/ after [+coronal] stops. These sonorants did appear, however, when velar assimilation occurred, e.g. truck [gɪʌk] (2;6,23) (cf. Smith, p.74).

Although the two types of velar-dental interchange are the only processes which are specifically limited to these places of articulation for stops, data from the children also showed apparent phonetic constraints on other processes based on the place of articulation of the stop. For instance, Ronjat stated that between 2;7 and 2;9 [gr-] was produced alternately as [r-], [ʔr-] or in its adult form. An early condition of A.'s phonology required that all consonants in the word be /l/ or else none; this condition produced trolley as [lɔli:] at 2;2. In Czech, Charles produced dlouho 'long' as [louho] at 2;0, and Grégoire's subject Charles produced clou 'nail' as [lu] at 1;11. These examples seem to indicate that stop-deletion (L in Table II) may be limited to dentals and velars for the group of children studied; however, this process is comparatively rare in the data as a whole, so this generalization may be a spurious one.[12]

Another accidental gap, or possible instance of phonetic conditioning is stop-weakening; in the data, stop-weakening also applied to dentals and velars.

(footnote 11 continued)

and kitchen [gigən] provide examples of perservative assimilations during the same time period (cf. Smith p. 20-21). Velar assimilation is a subpart of general consonant-harmony rules which are so widespread they may constitute an acquisitional universal (Smith, p.162). Consonant-harmony processes have also been discussed by Fudge (1969), Ferguson, Peizer, and Weeks (1973) and Ingram (1971).

[12] Ronjat's son Louis reduced initial br- to r- in one instance.

Table III
Stop-Weakening in the Speech of Four Children

Czech	French	English
droždí 'yeast' [hložd'i:] (2;8)	Charles: clou 'nail' [hlu] (2;3,10)	A: troddler [trɔgl^{ə}] ~ [srɔgl^{ə}] ~ [sɔgl^{ə}]
dlouhý 'long' [hlouhi:] (2;7)	Edmond: trou 'hole' [sju] (2;3, 5)	
kladivo 'hammer' [xlad'ivo] (2;7)		
kram 'shop' [xla:m] (2;8)		

While weakening and stop-deletion as well as velar-dental interchange applied mainly to velars and dentals in the data, other overlapping processes cut across stop-articulations. The earliest stages of production, namely ∅ and liquid-deletion, applied to all cases of clusters, although ∅ was infrequent (cf. the French and Estonian data for early productions). Louis Ronjat, however, used deletion of velar stops as well as deletion of the whole cluster later than did the other two French-speaking children. Thus, Edmond produced brouette 'wheelbarrow' as 'ouette' at 2;0,19 and crayon 'pencil' as 'iyon' at the same age, while Louis used gris 'grey' in the form [i] at 2;0 and grand 'big' as [^{a}rã] at 2;4.

Once past the relatively consistent use of liquid-deletion, liquid substitutions appear as 'recognitions' of the liquid. In some cases, this recognition may indeed be minimal, appearing as a coarticulation of the stop, e.g. affrication and palatalization. Hildegard Leopold's production of cracker as [kxakxa] at 1;7 may be an example of this. Edmond's forms, train as [t'i] and tram [tʃam] at 2;1, show a preliminary distinction between simple stops and stop-liquid clusters. Table IV documents the substitutions for /r/ in the data, with ages and examples. It is interesting that, in spite of the phonetic differences between the /r/'s in the five languages, the children's substitutions are quite similar.[13]

[13] The French /r/ is uvular [ʁ]; in Slovenian, Czech and Serbian /r/ is an apical trill, and in American English /r/ is a labialized continuant [ɹ^{w}].

Table IV

Substitutions for /r/

Language	r → l	r → w	r → stop^{w}	Other
Czech	2;6-3;5 brada 'chin' [blada]	—	—	—
English (Smith)	2;6-2;9 bread [blɛd]	—	2;6 and 3;2 brown [b^{w}aun]	[ṛ] 'syllabic r' 2;9,15 pretty [ṛiti:]
French (Grégoire)	2;1-2;2 brûle 'burns' [blu]	2;2-2;9 grand 'big' [gwã]	—	[r:] 2;5 train 'kr:ain' [r^{w}] 2;2-2;6 crème' cream' 'cr^{w}e:me' [j] 2;1-2;5 train tjain'
French (Ronjat)	—	—	—	r ?* 1;10 prune [pʉ?n]
Serbian	1;10 tri 'three' [tli]	—	—	—
Slovenian	1;11 drugo 'another' [dlugo]	—	—	—

* Ronjat's use of the symbol ? does not mean a glottal stop, but rather a kind of /r/ which he describes as 'non roulée, avec un timbre [u] très frappant.' (p. 47). Louis' production of prune also shows avoidance of an initial cluster by means of metathesis, since a presumable intermediate form is *p?ʉn.

Substitutions for /r/ may also be dependent on place of articulation of the stop; for example, Charles and Edmond substituted [w] for /r/ after velars and labials, while other substitutions apparently occurred with all types of stops (cf. Charles: bruyère 'briar' as 'bwiye:re' (2;0) and Edmond: bras 'arm' as [bwa] (2;2, 23); but Charles graisse 'fat' [glɛs] at 2;1).[14] Table IV shows the substitutions for /r/ made by both Charles and Edmond. The apparent phonetic conditioning of the /r/-substitutions may constitute another gap in the data, or they may result from an avoidance strategy, since Grégoire summarizes Charles' development of /r/ in clusters as follows:

a) (2;0-2;1) [l] is substituted for /r/;
b) (2;3) beginning of [w] as a substitute for /r/;
c) (2;5) /r/ appears more frequently in clusters;
d) (2;8-3;0) /r/ appears consistently in initial clusters. (1947:311)

In the course of mastering the articulation of liquids, there are also hypercorrections; thus, Charles Ohnesorg produced dlouho 'long' as [drouho] at 3;5 during the time when his substitution of /r/ fell out in favor of adult productions. The migration or metathesis of liquids may take the form of perseverations, as in A.'s production of Clapham Common as [klaepᵊn klɔmən] at 2;11, 3. In the three languages which contain examples of liquid-migration, this process occurs at the time when at least some stop-liquid clusters are being produced correctly. The French example from Ronjat, however, appears to be an isolated instance resulting from an early strategy for avoiding initial clusters (cf. Table IV). Charles and Edmond apparently used metathesis both to avoid initial clusters from underlying simple stops, e.g., Charles: brouillard 'wheelbarrow' as 'bouryar' (2;5), trompette 'trumpet' as 'tonprette' (2;6); Edmond: tranquille 'quiet' as 'tanqrille' (2;8). At the same time Charles produced tourne 'turns' as 'troune' (2;6) and portes 'doors' as 'protes' (2;5). The puzzling thing about these examples is that they were produced around the same time. A.'s speech also contained examples of metathesis as a cluster-avoiding strategy: the word blue was produced as [b̥u:] ~ [blu:] at 2;6, 16, as [b̥u:] ~ [bu:l] at 2;6, 23, and finally as [blu:] again at 2;7, 17.

Perseveration, like that in the Clapham Common example, is similar to the overgeneralization of /r/ by Charles Ohnesorg; in

[14] For English speaking children, [w] is widely reported as a substitute for /r/ in clusters and in single occurrences. The phonetic conditioning of /r/ substitutions for English-speaking children seems to reside in the labialized characteristics of /r/, and not in the nature of the preceding consonant, for stop +r clusters.

both cases, once the articulation of the liquids was mastered, the child extended them to forms where they should not have appeared. Grammont (1933:247-8) provides examples of metathesis from the speech of a French child, G.B., which parallel those from Charles and Edmond, although produced at an earlier age. G.B. avoided internal r+C and C+r clusters by metathesis between the ages of 1;10 and 2;0, e.g. couverture 'cover, blanket' appeared as 'crouveture' and porte-moi 'carry me' as 'prote-moi.' Although metathesis and liquid migrations seem to appear late in development, a comparison of G.B.'s forms with the data from Ronjat and Grégoire reveals a certain amount of individual variation.

Grammont also points out the similarity of G.B.'s use of metathesis to the mobility of liquids in historical sound change (cf. Latin cancer 'crab', Vulgar Latin cracus, and Old French cranche). Metathesis is only one instance of the many parallels that can be drawn between historical change and children's acquisition of consonant clusters. To take another example, epenthesis and liquid deletion are employed to reduce consonant clusters when loanwords violate phonetic constraints of the target language.[15] Parallels between processes operative on consonant clusters in child language and in historical change provide an interesting illustration of the similarity between the two forms of diachrony and their cohesive character.

To assert that a child's phonology is cohesive, however, does not preclude variation in production. Although several processes appear to be operative at approximately the same time period for the children considered here (cf. Table II), there is clearly room for individual variation across languages and across children in regard to four factors: 1) whether or not some general processes apply to all cluster types; thus epenthesis is found in Ohnesorg's records for Charles, but it does not occur for stop-liquid clusters; 2) how many phonetic replacements are employed for liquids by an individual child; 3) the extent to which liquid replacements overlap with correct productions of clusters; 4) within the group of children in the data, the duration of particular processes, such as velar-dental interchange, may also vary. This variation is not surprising, especially given that a single child may show fluctuation between all these major stages of production, from simple stop to adult clusters, in the space of a month, as in A.'s case (see above, p. 92).

In general the course of development was very similar across the six languages from which data were taken. All the children

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[15] For a treatment of these processes in the nativization of loanwords, see Greenlee (forthcoming).

whose speech was studied up until the time at which clusters began to appear in their adult form manifested the same three major stages of production. The substitutions for liquids were unexpectedly similar, in view of the somewhat different phonetic characteristics of /r/ in the six languages. Particular subprocesses such as stop-weakening and stop-deletion seemed to be controlled by similar phonetic conditions. Within the three production stages overlapping application of phonological processes was characteristic for children learning five of the languages; for the sixth, Estonian, there were no data on later productions, but it too might have shown such overlapping processes. Variation in the production of stop+liquid clusters appears to fall within predictable limits for particular phonological processes, although there may also be some idiosyncratic variation across children. The variation itself may also be governed by certain phonetic features of the adult cluster or by specific lexical items. The child may apply one process to particular words rather than to all lexical items with a regular phonetic shape. Lastly, variation may result in "conspiracies" if particular processes are compatible and are all applied. Otherwise, there may be variation between different processes. Alternative productions were particularly evident during the liquid-substitution stage, and were characteristic of the children studied.

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